Gas Consumption Calculations - Worked Examples

Refer EARLY to KIDSNTS for advice - 0300 200 1100

Hamilton T1

Example 1. 3.6 kg 4 week old infant. Ventilation rate of 40 in 45% oxygen. Tidal volume is 6mls/kg. Ventilator in Neonate mode. Journey time is 80 mins.

[(ExpMinVol (L/min) x 2) + 3 L/min] x [(O2% – 20.9) ÷ 79.1]

→ [(0.8694 (L/min) x 2) + 3 L/min] x [(45 – 20.9) ÷ 79.1]

→ [1.73 + 3] x [24.1 ÷ 79.1]

→ 4.73 x 0.30 = 1.44 L/min = Oxygen Consumption

→ 1.44 L x 80 mins = 115.2 L x 2 = 230.4 L of oxygen required for this journey.

Hamilton T1

Example 2. 43 kg male. Ventilation rate of 25 in 65% oxygen. Tidal volume is 7 mls/kg. Ventilator in Adult/Paediatric mode. Journey time is 45 mins.

[ExpMinVol (L/min) + 4 Lmin] x [(O2% – 20.9) ÷ 79.1]

→ [7.53 (L/min) + 4 L/min] x [(65 – 20.9) ÷ 79.1]

→ 11.53 x [44.1 ÷ 79.1]

→ 11.53 x 0.56 = 6.46 L/min = Oxygen Consumption

→ 6.46 L x 45 mins = 290.7 L x 2 = 581 L of oxygen required for this journey

Leoni

Example 1. 850g preterm infant. Ventilation rate of 60 in 65% oxygen. Tidal volume is 5 mls/kg. Ventilator in SIMV mode. Journey time is 45 mins.

MinVol = Tidal Volume x Rate = Total flow of both gases/min

→ 4.25 mls x 60 = 0.255 L/min Total Gas Flow.

O2 Flow = MinVol x [(O2% - 20.9) ÷ 79.1]

→ 0.255 x [(65 - 20.9) ÷ 79.1]

→ 0.255 x [44.1 ÷ 79.1]

→ 0.255 x 0.56 = 0.14 L/min oxygen consumption

Air Flow = Total Flow - O2 Flow

→ 0.255 - 0.14 = 0.12 L/min air consumption

→ 0.14 L x 45 mins = 6.3 L x 2 = 12.6 L of oxygen required for this journey

→ 0.12 L x 45 mins = 5.4 L x 2 = 10.8 L of air required for this journey

Leoni

Example 2. 2.8 kg term infant. On CPAP in 35% oxygen. Tidal volume is 5 mls/kg. Journey time is 40 mins.

MinVol = 12 L/min = Total flow of both gases/min

O2 Flow = MinVol x [(O2% - 20.9) ÷ 79.1]

→ 12 x [(35 - 20.9) ÷ 79.1]

→ 12 x [14.1 ÷ 79.1]

→ 12 x 0.178 = 2.14 L/min oxygen consumption

Air Flow = Total Flow - O2 Flow

→ 12 - 2.14 = 9.86 L/min air consumption

→ 2.14 L x 40 mins = 85.6 L x 2 = 171.2 L of oxygen required for this journey

→ 9.86 L x 40 mins = 394.4 L x 2 = 788.8 L of air required for this journey

HiFlow on Hamilton T1 & Leoni Ventilators

Example 1. 2.6 kg infant. 6L/min Flow in 40% oxygen. Journey time is 110 mins.

Set Flow = Total gas flow L/min

O2 Flow = Set Flow x [(O2% - 20.9) ÷ 79.1]

→ 6 x [(40 - 20.9) ÷ 79.1]

→ 6 x [19.1 ÷ 79.1]

→ 6 x 0.24 = 1.45 L/min oxygen consumption

Air Flow = Total Flow - O2 Flow

→ 6 - 1.45 = 4.55 L/min air consumption

→ 1.45 L x 110 mins = 159.5 L x 2 = 319 L of oxygen required for this journey

→ 4.55 L x 110 mins = 500.5 L x 2 = 1001 L of air required for this journey

Gas Calculations

HiFlow on Hamilton T1 & Leoni Ventilators

Example 2. 45kg male. 60L/min Flow in 80% oxygen. Journey time is 90 mins.

Set Flow = Total gas flow L/min

O2 Flow = Set Flow x [(O2% - 20.9) ÷ 79.1]

→ 60 x [(80 - 20.9) ÷ 79.1]

→ 60 x [59.1 ÷ 79.1]

→ 60 x 0.74 = 44.4 L/min oxygen consumption

Air Flow = Total Flow - O2 Flow

→ 60 - 44.4 = 15.6 L/min air consumption

→ 44.4 L x 90 mins = 3996 L x 2 = 7992 L of oxygen required for this journey

→ 15.6 L x 90 mins = 1404 L x 2 = 2808 L of air required for this journey

**** This journey is not possible on 2 counts ****

1. **The flow of oxygen is greater than the maximum of 40L/min through Schrader valves on cylinder oxygen.**
2. **The total volume of gases exceeds what can be carried on the KIDSNTS ambulances. The total flow or oxygen % could be reduced but there would be no room for increasing oxygen delivery..Alternative ventilatory support should be considered.**

Author - AG - V1.3 March 2025 Review March 2028.